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(71) Applicant *(for all designated States except US)*: IMMERSION CORPORATION [US/US]; 801 Fox Lane, San Jose, CA 95131 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: GRANT, Danny [CA/CA]; 6678 Chateaubriand, Montreal, Québec H2S 2N7 (CA). EID, Jeffrey [US/US]; 105 Shadwell Drive, Danville, CA 94506 (US). ENDO, Shoichi [JP/US]; 20268 Northwest Square, Cupertino, CA 95014 (US).

(74) Agents: ALEMANNI, John, C. et al.; Kilpatrick Stockton LLP, 1001 West Fourth St., Winston-Salem, NC 27101 (US).

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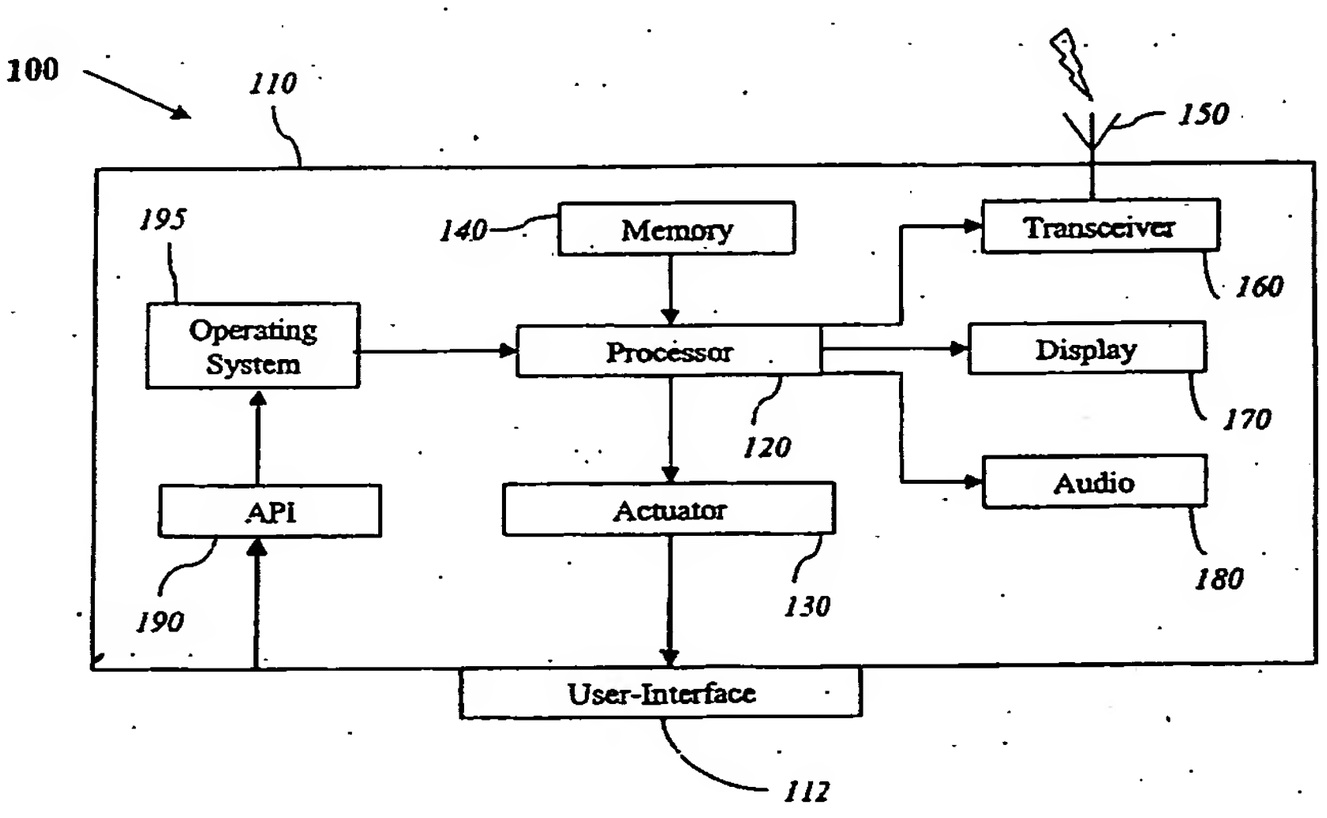
(54) Title: HAPTIC MESSAGING IN HANDHELD COMMUNICATION DEVICES



(57) Abstract: Embodiments of the invention relate to methods and systems for providing customized "haptic messaging" to users of handheld communication devices (110) in a variety of applications. In one embodiment, a method of haptic messaging includes: receiving an input signal associated with an actuation of a user-interface member (112); determining a haptic code associated with the actuation; and including the haptic code in an output signal to be sent to a remote handheld communication device (10). In another embodiment, a method of haptic messaging includes: receiving an input signal; outputting a request relating to a contact with a user-interface member (112) coupled to a handheld communication device (110); and providing a control signal associated with the contact to an actuator (130) coupled to the handheld communication device (110), the control signal being configured to

WO 2004/053671 A1

the scope of the invention in any manner. One skilled in the art would also recognize that various changes and modifications can be made herein, without departing from the principles and scope of the invention.

FIG. 1 depicts a block diagram of a handheld communication device 100 according to an embodiment of the invention. It will be appreciated that various elements are shown in schematic form for illustrative purposes and are not drawn to scale. It will also be appreciated that many alternative ways of practicing the present invention exit. Accordingly, various changes and modifications may be made herein, without departing from the principles and scope of the invention.

Device 100 includes a device body including a housing 110 and a user-interface 112; a processor 120; at least one actuator 130 in communication with processor 120; and a memory 140 in communication with processor 120. Device 100 also includes an antenna 150 and a transceiver 160, in communication with processor 120. Device 100 additionally includes a display module 170 and an audio module 180, in communication with processor 120. Display module 170 may include, for example, a liquid crystal device. Audio means 180 may include, for example, a speaker, a microphone, and the like.

For purpose of illustration in the embodiment of FIG. 1, processor 120, actuator 130, and memory 140 are shown to be enclosed within and coupled to the device body. Such an illustration, however, should not be construed as limiting the scope of the invention in any manner. In alternative embodiments, actuator 130 may, for example, be coupled to the outside of housing 110, or embedded in housing 110 via a suitable mechanism. Further, user-interface 112 may include one or more user-interface members. As used herein, a user-interface member includes, without limitation, a key pad having one or more keys, one or more buttons, a touch screen or touch pad, a scroll wheel, a direction pad, a trackball, a knob, a miniature joystick, or other user-interface means known in the art.

Device 100 further includes an API (Application Program Interface) 190, working in conjunction with an operating system 195. A device driver (not shown) may optionally provide an interface between operating system 195 and processor 120.

Memory 140 of device 100 stores a program code that includes instructions to cause processor 120 to perform various tasks. The following description provides some examples.

FIG. 2 shows a flowchart 200 depicting a method of using customized haptic effects to convey information to users of handheld communication devices, according to an embodiment of the invention. At step 210, an input signal associated with an event is received. At step 220, a source of the event is determined and a control signal is selected

configured according to a predetermined scheme or protocol that includes, for example, a table of haptic codes (some of which may be associated with one or more haptic logos) versus control signals for rendering the corresponding haptic effects. In this way, a processor in the handheld communication device can look up the corresponding control signal from the table based on the extracted haptic code, and output the selected control signal to the actuator for rendering the desired haptic effect.

In the embodiments of FIG. 2 or 3, the handheld communication device (or the haptic code) may be programmed such that the haptic effect is output immediately, or at a prescribed time after receiving the input signal, as desired in applications. The haptic effects can also be triggered by, or synchronized with, other occurrences.

A handheld communication device may be further configured such that some of its user-interface members (such as those described above) are each associated with a haptic code, e.g., according to a predetermined scheme or protocol. In one embodiment, some of these haptic codes may be associated with haptic effects that emulate expressions or behaviors, such as "laugh," "giggle," "hug," "high-five," "heartbeat," "pet purring," etc. This allows haptic effects to be transmitted and experienced, e.g., in an interactive conversation or a chat session, by pressing or manipulating such members.

By way of example, suppose that user A (termed "Alice" herein) is engaged in a chat session with user B (termed "Bob" herein) via their respective mobile phones. In one embodiment, when Bob tells Alice a joke, Alice can respond by sending a "laugh" sensation to Bob, e.g., by pressing a key on her mobile phone that is assigned with a haptic code corresponding to a laugh sensation. This causes a signal to be transmitted from Alice's phone to Bob's phone, and a corresponding haptic effect to be output to Bob's phone (and thereby experienced by Bob). In alternative embodiments, Alice can include a haptic code in an outgoing message (which may also contain a video image such as a picture taken by her mobile phone, and/or a graphical feature such as an emoticon emulating a smiley face) to be transmitted to Bob, e.g., by pressing the corresponding user-interface member. The haptic code causes a haptic effect to be output when the message is delivered to a remote device such as Bob's mobile phone. In one embodiment, the haptic effect may be correlated or synchronized with the displaying of a video image contained in the message. In another embodiment, the generation of the haptic effect based on the haptic code may be carried out in a manner similar to that described above with respect to the embodiment of FIG. 3.

FIG. 4 depicts a flowchart 400 illustrating a method of a method of haptically encoding communication signals, according to an embodiment of the invention. At step 410,

effect may include one or more pulse or jolt sensations, where the number of pulses is proportional to the number of miles between the position of the handheld device and the destination.

Processors described above (including processor **120** of FIG. **1**) can include, for example, one or more digital logical processors capable of processing input, execute algorithms, and generate output as necessary to perform various tasks, such as those described above. Such processors/controllers may include a microprocessor, an Application Specific Integrated Circuit (ASIC), and state machines. Such processors include, or may be in communication with, media (including memory **140** of FIG. **1**). Such media include, for example, computer readable media, which stores program code that, when executed by a processor, cause the processor to perform the steps described herein. Embodiments of computer-readable media include, but are not limited to, an electronic, optical, magnetic, or other storage or transmission device capable of providing a processor, such as the processor in a web server, with computer-readable instructions. Other examples of suitable media include, but are not limited to, a floppy disk, CD-ROM, magnetic disk, memory chip, ROM, RAM, ASIC, configured processor, all optical media, all magnetic tape or other magnetic media, or any other medium from which a computer processor can read. Also, various other forms of computer-readable media may transmit or carry instructions to a computer, including a router, private or public network, or other transmission device or channel.

Program code and associated application programs related to various applications may also reside on a remote source, such as a network resource, a Web server, a remote handheld communication device or computer, which can be transmitted or downloaded to a handheld communication device on a regular or predetermined basis. Haptic effects (along with associated control signals) can also be downloaded or transmitted from a remote source, as described above.

Actuators described above (including actuator **130** shown in FIG. **1**) can include, for example, a pager motor, an eccentric rotating motor, a harmonic eccentric rotating motor, a voice coil, a solenoid, a resistive actuator, a piezoelectric actuator, an electro-active polymer actuator, or other types of active/passive actuators suitable for generating haptic effects. U.S. Patent Nos. 6,429,846 and 6,424,333 disclose further details relating to some of these actuators, both of which are incorporated in full herein by reference. In some embodiments, one or more actuators may be implemented in a handheld communication device, configured to deliver appropriate haptic effects. It will be appreciated that various control schemes can

That which is claimed is:

1. A method, comprising:

receiving an input signal associated with an actuation of a user-interface member;

determining a haptic code associated with the actuation; and

including the haptic code in an output signal.

2. The method of claim 1 further comprising sending the output signal to a remote handheld communication device.

3. The method of claim 1 further comprising including in the output signal at least one of a message, a video image, and a graphical feature.

4. The method of claim 1 further comprising making the determination is based on a predetermined scheme.

5. The method of claim 1 wherein the user-interface member includes at least one of a key, a button, a key pad, a direction pad, a touch screen, a scroll wheel, a mini-joystick, a trackball, and a knob.

6. A method, comprising:

receiving an input signal;

outputting a request relating to a contact with a user-interface member coupled to a handheld communication device; and

providing a control signal associated with the contact to an actuator coupled to the handheld communication device, the control signal configured to cause the actuator to output a haptic effect associated with the input signal.

7. The method of claim 6 further comprising extracting a haptic code from the input signal, the control signal being based at least in part on the haptic code.

8. The method of claim 6 further comprising causing a content of the input signal to be displayed, the content includes at least one of a message, a video image, and a graphical feature.

9. The method of claim 6 wherein the user-interface member includes one of a key, a button, a key pad, a direction pad, a touch screen, a scroll wheel, a mini-joystick, a trackball, and a knob.

10. A computer-readable medium on which is encoded program code, comprising:

program code for receiving an input signal associated with an actuation of a user-interface member;

program code for determining a haptic code associated with the actuation; and

program code for including the haptic code in an output signal.

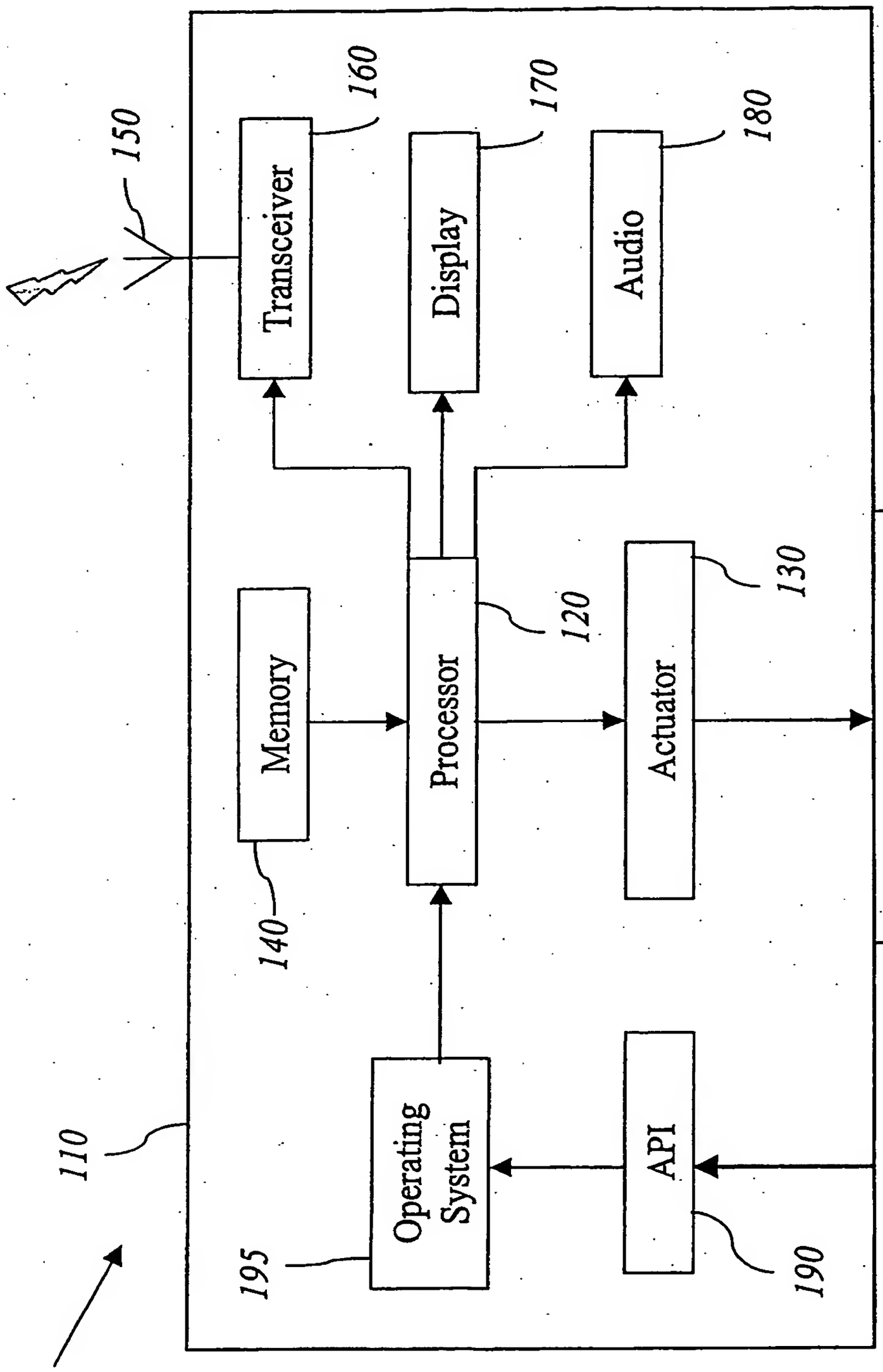

100
110
150
160
Transceiver
170
Display
180
Audio
Memory
140
Processor
120
Actuator
130
User-Interface
112
Operating System
195
API
190

FIG. 1

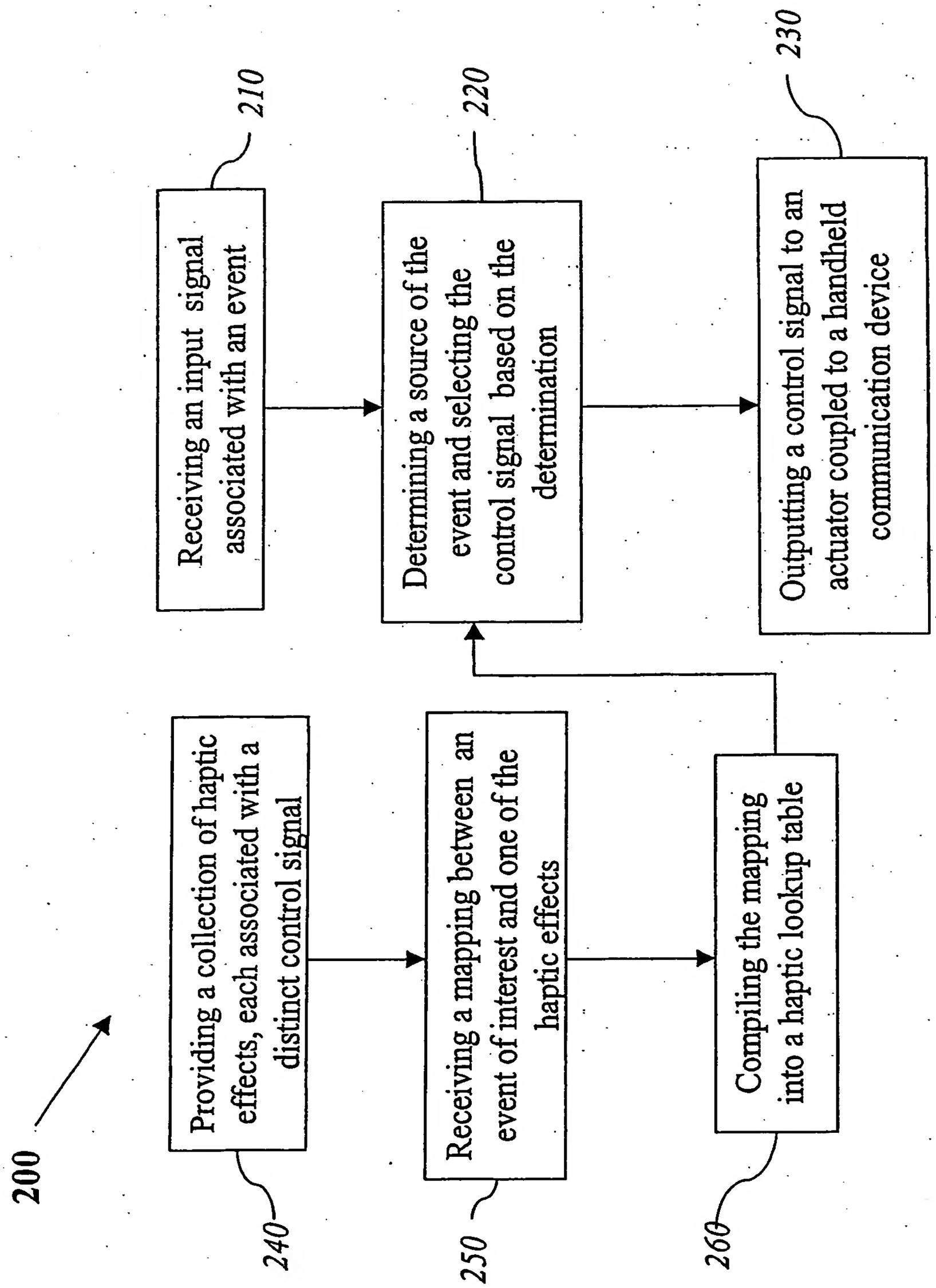

200
210
Receiving an input signal associated with an event
220
Determining a source of the event and selecting the control signal based on the determination
230
Outputting a control signal to an actuator coupled to a handheld communication device
240
Providing a collection of haptic effects, each associated with a distinct control signal
250
Receiving a mapping between an event of interest and one of the haptic effects
260
Compiling the mapping into a haptic lookup table

FIG.2

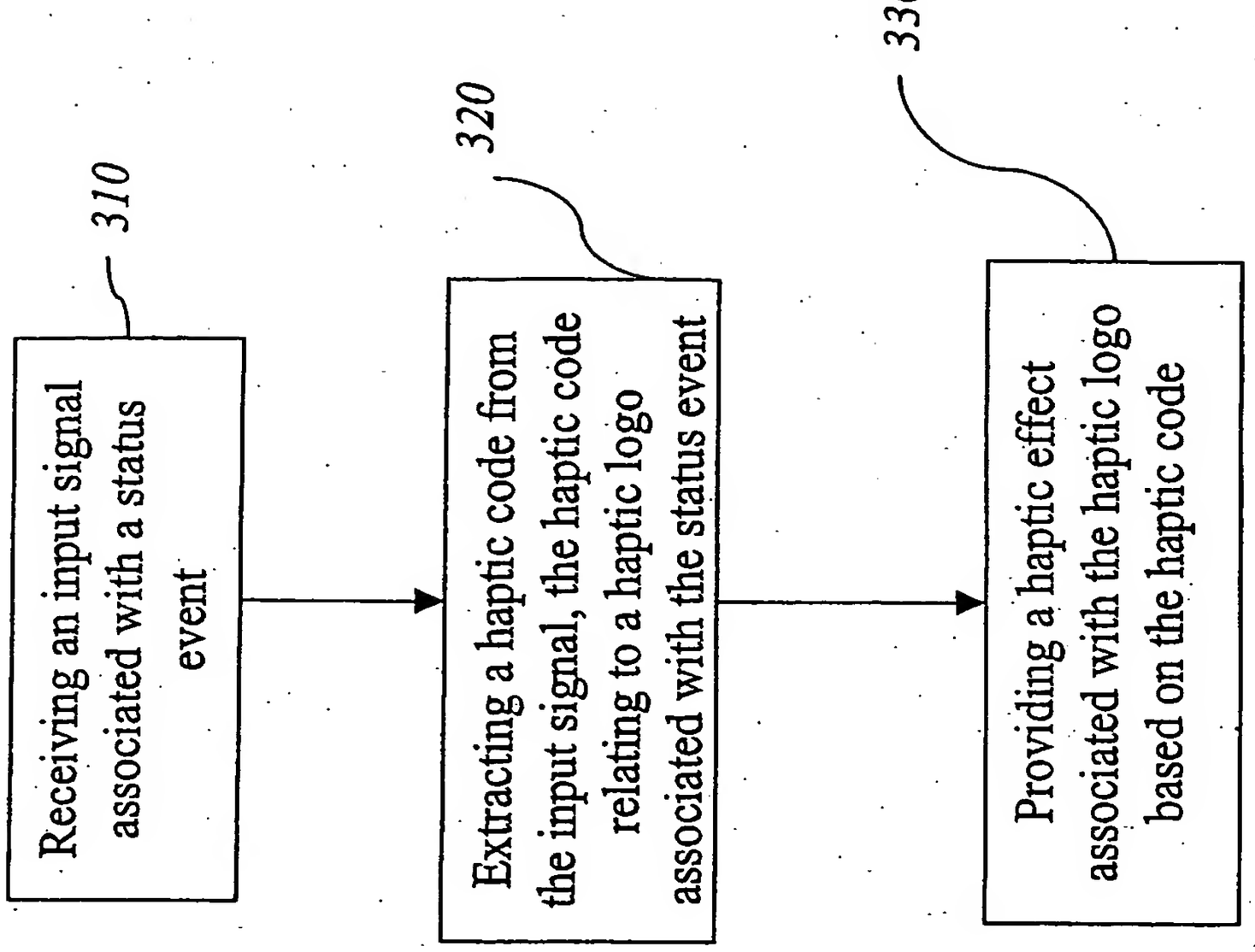

300
310
Receiving an input signal associated with a status event
320
Extracting a haptic code from the input signal, the haptic code relating to a haptic logo associated with the status event
330
Providing a haptic effect associated with the haptic logo based on the haptic code

FIG. 3

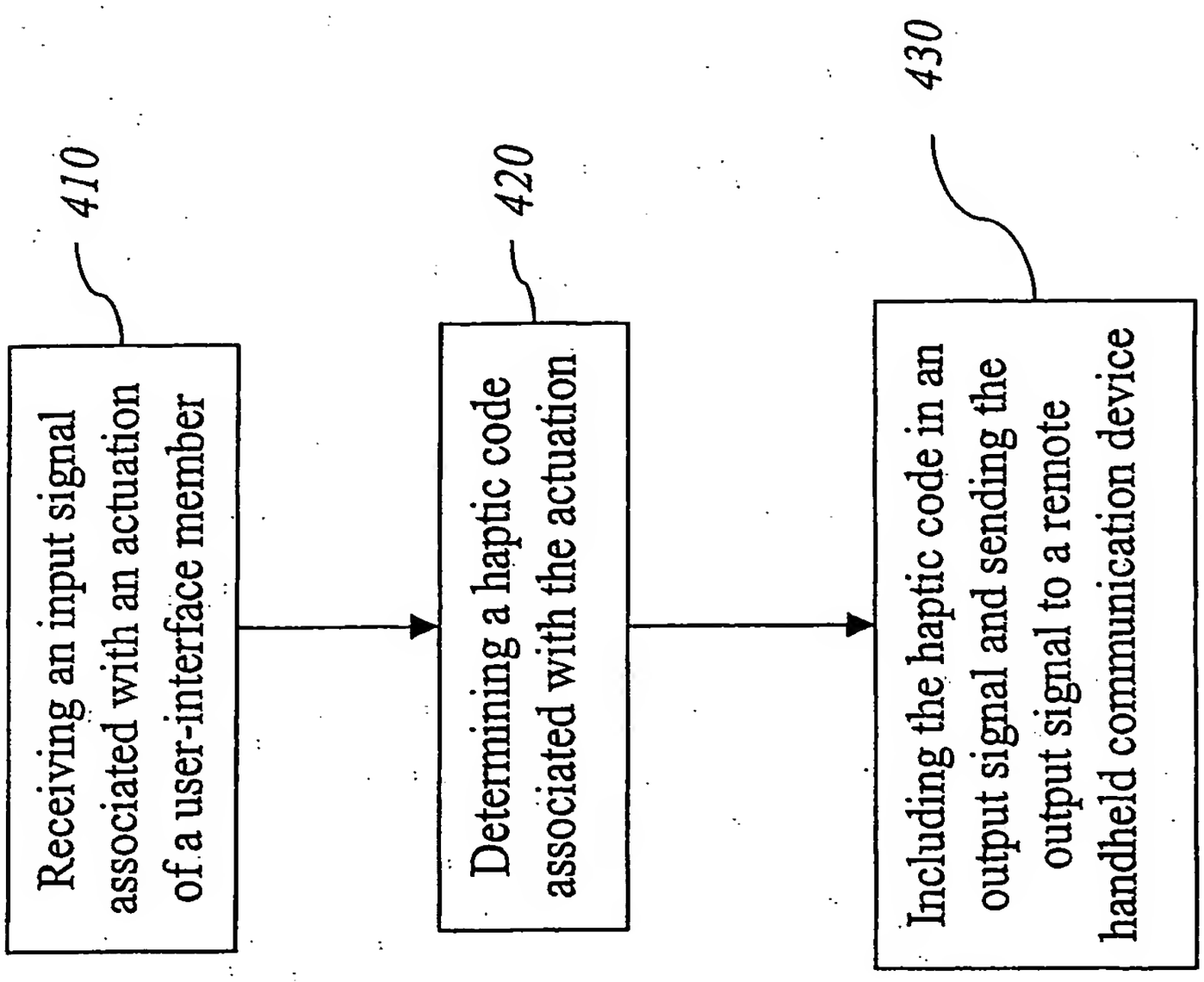

400
410
Receiving an input signal associated with an actuation of a user-interface member
420
Determining a haptic code associated with the actuation
430
Including the haptic code in an output signal and sending the output signal to a remote handheld communication device

FIG. 4

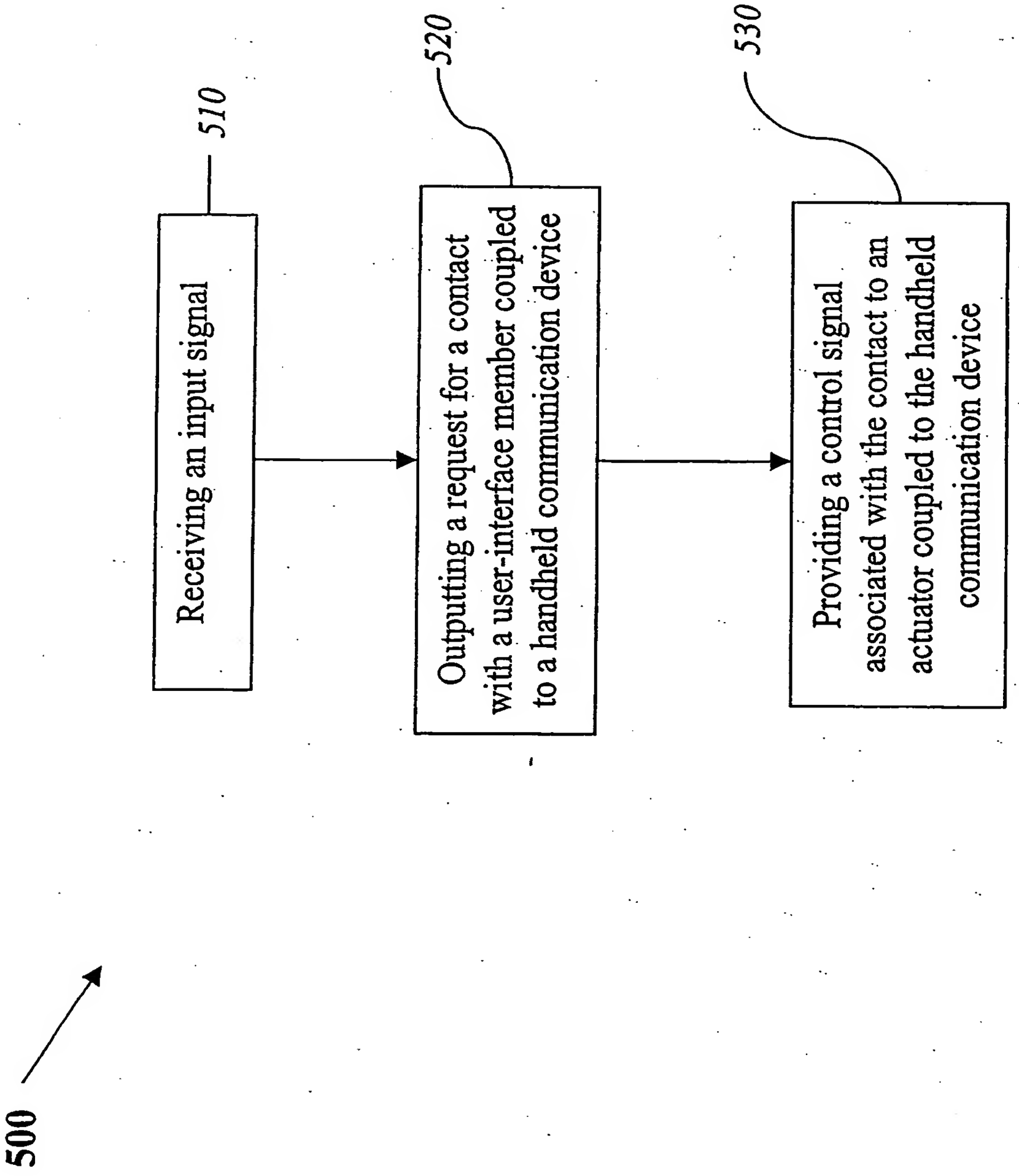

500
510
Receiving an input signal
520
Outputting a request for a contact with a user-interface member coupled to a handheld communication device
530
Providing a control signal associated with the contact to an actuator coupled to the handheld communication device

FIG. 5

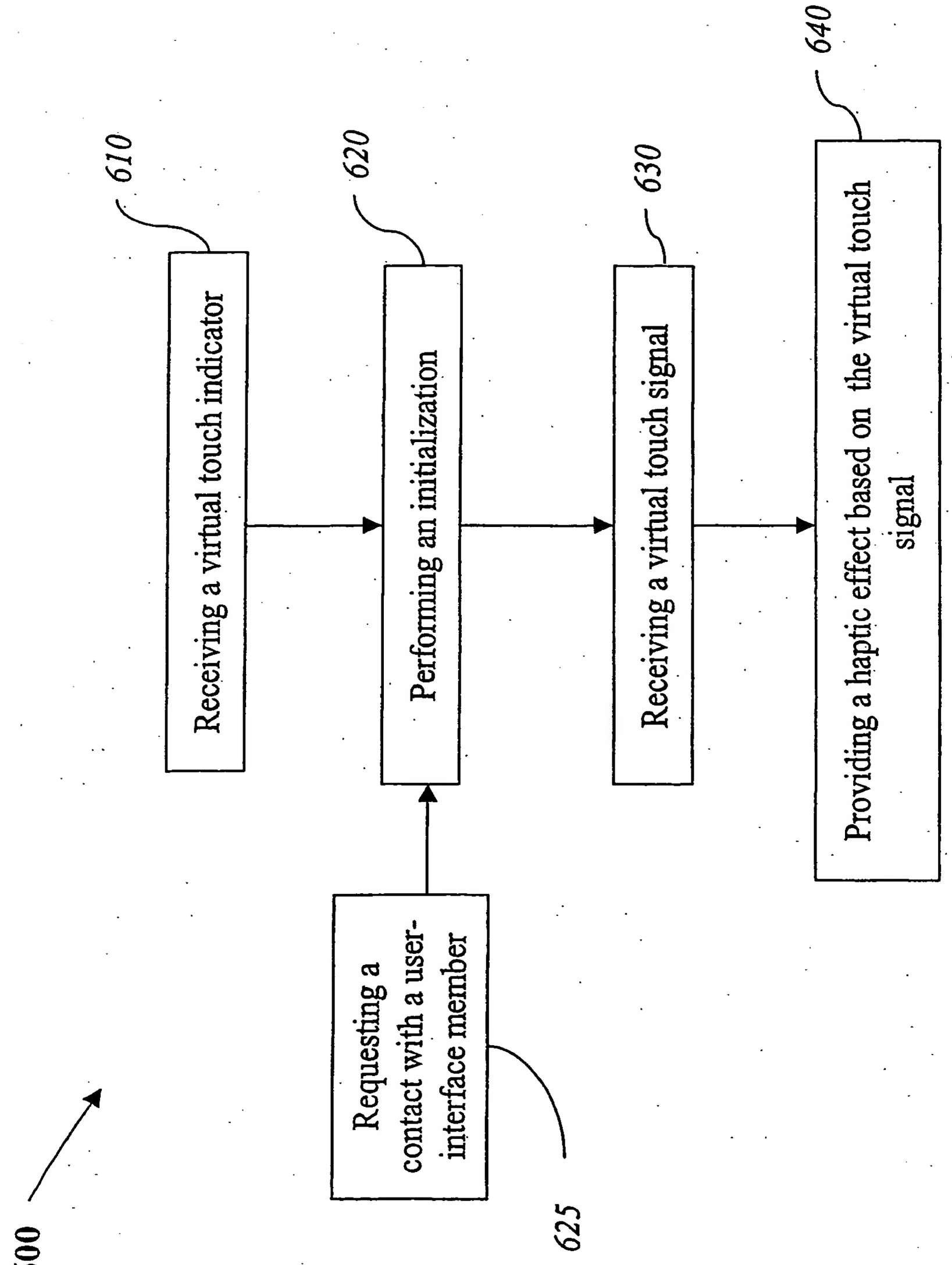

600
Requesting a contact with a user-interface member
625
Receiving a virtual touch indicator
610
Performing an initialization
620
Receiving a virtual touch signal
630
Providing a haptic effect based on the virtual touch signal
640

FIG. 6

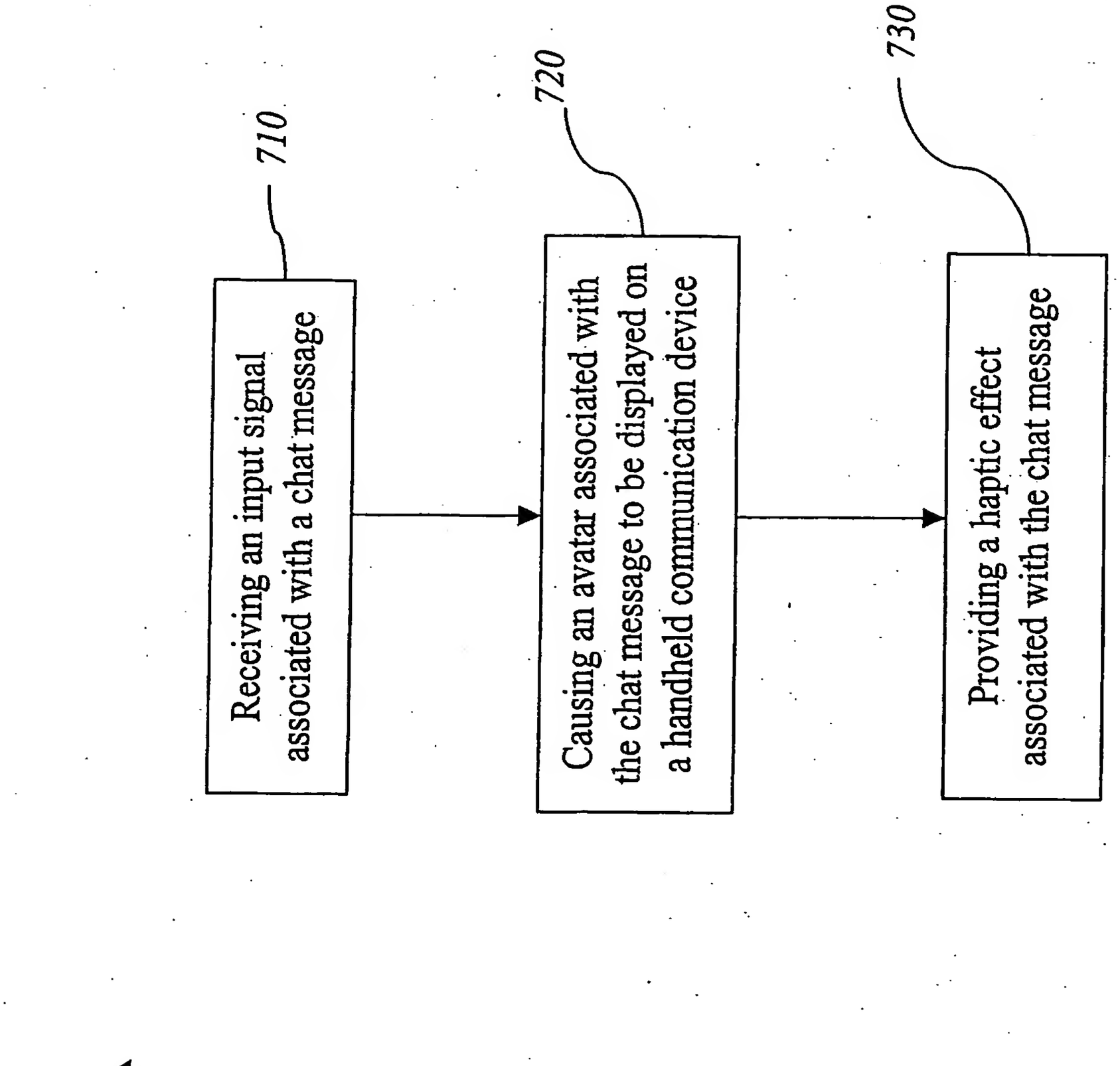

700
710
Receiving an input signal associated with a chat message
720
Causing an avatar associated with the chat message to be displayed on a handheld communication device
730
Providing a haptic effect associated with the chat message

FIG. 7

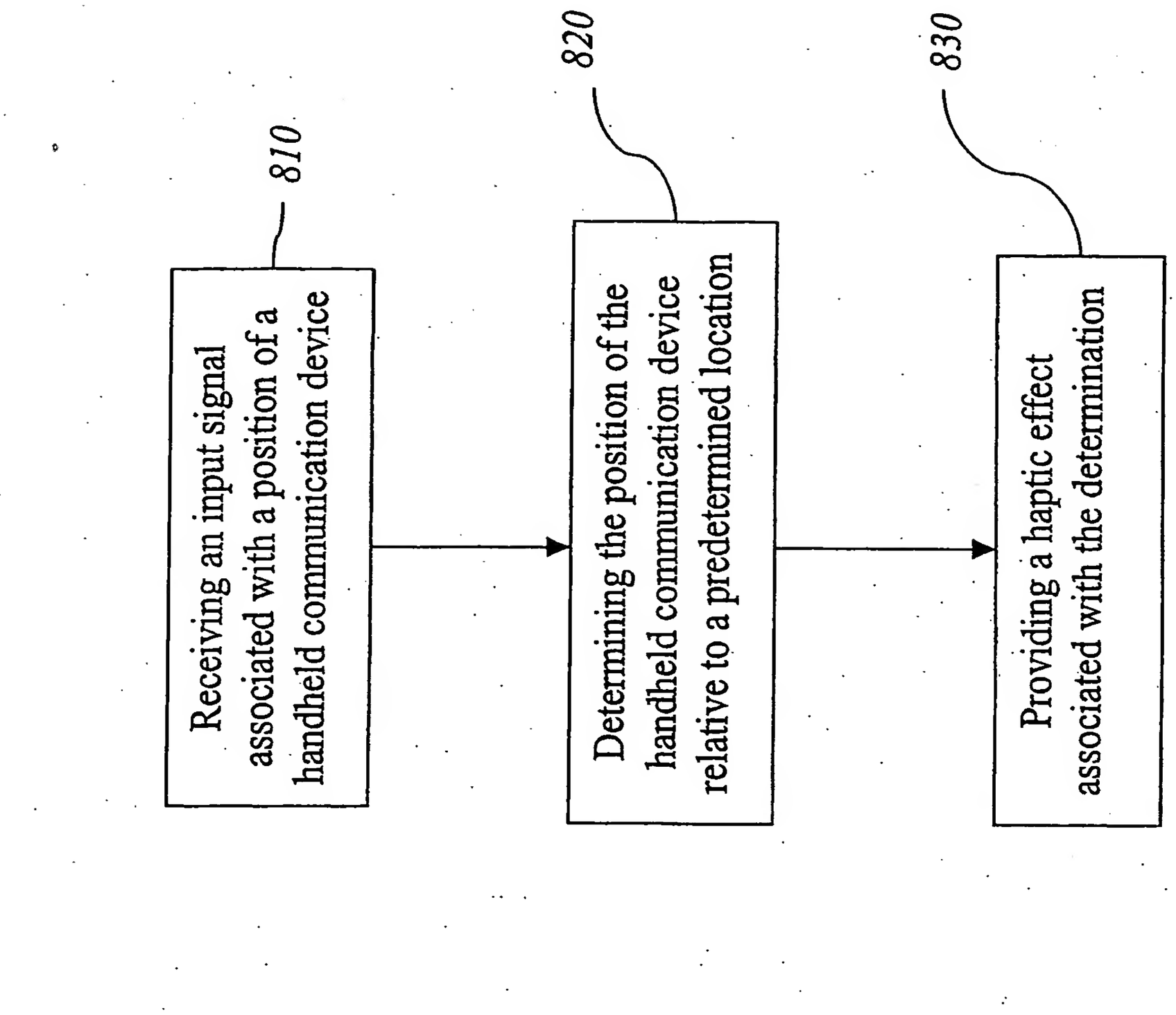

800
Receiving an input signal associated with a position of a handheld communication device
810
Determining the position of the handheld communication device relative to a predetermined location
820
Providing a haptic effect associated with the determination
830

FIG. 8

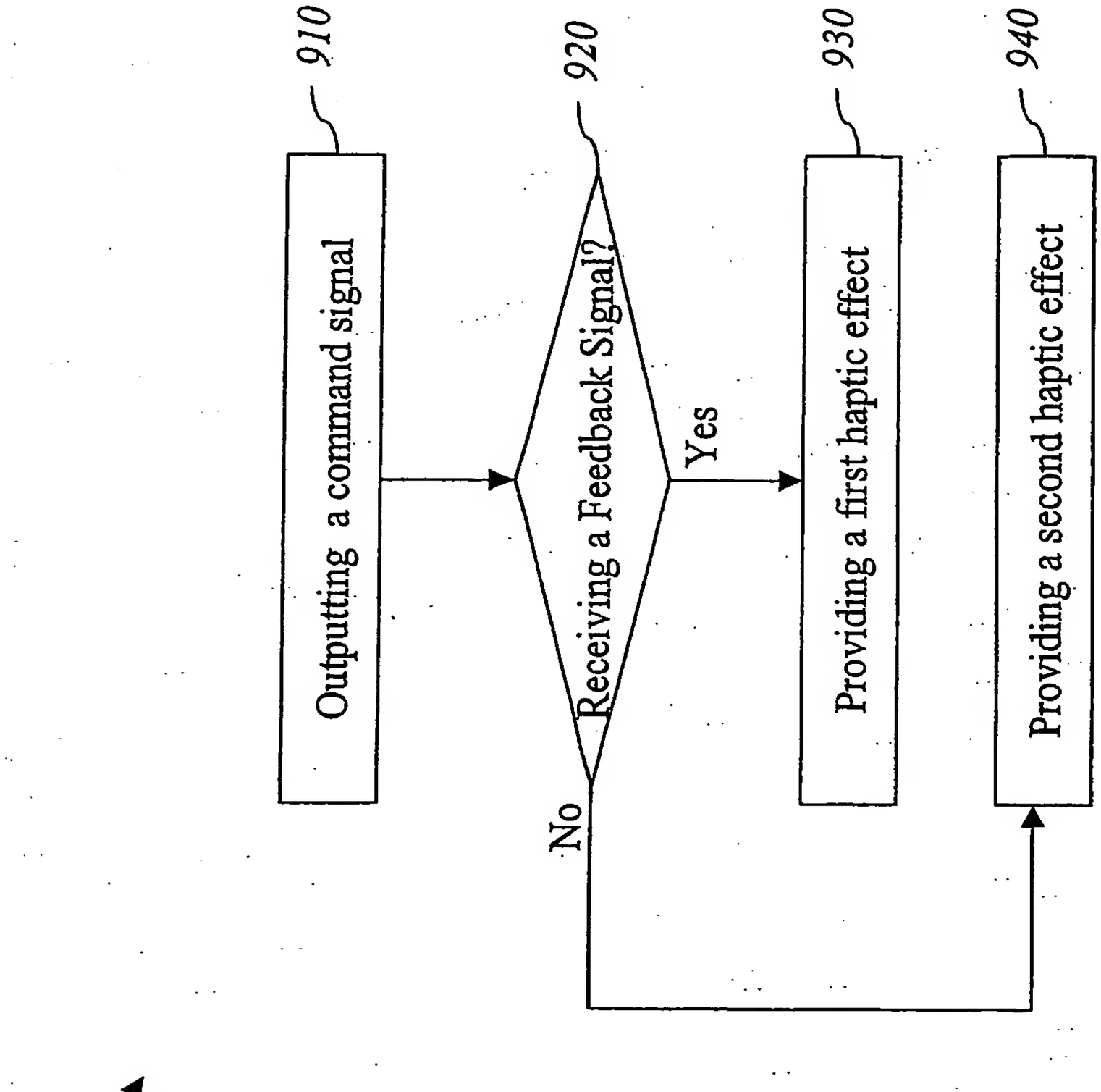

900
910
Outputting a command signal
920
Receiving a Feedback Signal?
Yes
No
930
Providing a first haptic effect
940
Providing a second haptic effect

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/38900

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : G 06 F 3/00; G 09 G 5/00
US CL : 710/5; 345/702
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 710/5; 345/702

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Microsoft Computer Dictionary

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
IEEE Xplore database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US 2003/0174121 A1 (POUPYREV et al) 18 September 2003 (18.09.2003), paragrpahs 3,33,43,46,48,49,74,76-79,81,106,111,128-131.	1-31
X — Y	US 6,429,846 B2 (ROSENBERG et al) 6 August 2002 (06.08.2002), column 2, lines 6-53; column 3, lines 39-63; column 5 lines 10-13; column 6, lines 55-67; column 7, lines 50-65.	1-5,10-13,17,19-25 ——— 6-9,14-16,18,26-31
Y	US 6,018,711 (FRENCH-ST. GEORGE et al) 25 January 2000 (25.01.2000), column 3, lines 14-67, column 5 lines 33-37.	6-9,14-16,18,26-31

☐ *Further documents are listed in the continuation of Box C.* ☐ *See patent family annex.*

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"&" document member of the same patent family

Date of the actual completion of the international search	*Date of mailing of the international search report*
23 March 2004 (23.03.2004)	14 APR 2004
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703)305-3230	Authorized officer Jeffrey A Gaffin Telephone No. 703 308-3900

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